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APPLICATION FOR A PATENT FOR AN INVENTION

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(54) Process for the reproduction of the sound of speech or music stored on a printed support or on a label.

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The present invention relates to the area of articulated. sound, in connection with periodicals, instruction, advertising, and the maintenance or explanation of materials.

It carries out the recording of speech in the form of small rods or points which have the location, width, height, and digital code value of the speech, either opposite to a written text or not, with the recording being decoded by means of an electronic device, preferably moved by the operator along the codes above, with this device reading the codes and marking them in time by means of a comparison clock and proceeding to the conversions that are necessary in order to obtain the articulated sound from a speaker at the end of the circuit.

When it is desired to obtain an articulated sound, the most immediate solution is to implement a device comprising a magnetic (or optical) recording corresponding to its recording.

If it is desired to connect a written text with such a sound recording (or its translation or its explanation), the first and the most immediate solution is to use a book, on the one hand, and a magnetic support device, on the other hand, with a human operator carrying out the intellectual work and the material connection of the phrase with its sound text.

The most simple solution in regard to the support is to have only a written support and a data processing device, in order to carry out the following:

- Recognition of the characters of the written text with the help of a device moving along the written lines;
- Access to a library of phonemes corresponding to the groupings of the letters;
- Access to a library of grammatical rules which allows the vocal utterance after passing through a vocal synthesizer (artificial voice).

This second solution is in the course of evaluation in the present world, but it will long be limited by its cost, by its specific library for every type of pronunciation, by the difficulty of taking intonation into account, except with printed additions, as well as by the need for training before obtaining a good understanding of it. In addition, the initial decoder will have to be adapted to every body of writing, which point does not appear to be insurmountable, but which may a source of errors, since writing alone does not have redundancy.

Among the two previous solutions -- which are the simplest and the most complex (at least in regard to the processing) -- numerous systems have found their niches:

1) Marking down on the written support the words and phrases by numbers and calling up the numbers by means of a keyboard management of the recording.

2) Coding these words or phrases by means of "bar codes" placed opposite to these words, for example, and directly summoning the corresponding part of the recording by means of an "optical pen" passed over the corresponding code.

This method is very sure; it is connected with the classical devices (book + magnetic tape recorder), and it is very convenient to carry out at the level of the written text (less numerous groups of printed bar codes, for example, at the same time as the text, or the placing of labels arranged at different points of a diagram or a material itself, in order to obtain the corresponding text).

It has its own niche of use and represents a good optimum quality, price, and commercial ease of introduction.

One such system is described in the French patent application number 7907350, entitled: "Process and device for the reproduction upon demand of fractions of recording" (inventors: L. Duthien, J.P. Volat, Ch. Palumbo, A. Armand).

3) Associating the written texts and the analogue magnetic recordings on the same support and on consecutive parallel lines, which allows the visual reading and listening by means of a pen with a magnetic head ending in a speaker, a device which is moved opposite to the direction of recording. A number of such systems are described in the US patent number 2548011, by L.T. Frost, and the French patent number 2176199, by Ganouna Cohen.

These systems are interesting, but the use of the magnetic coding makes the provision of the support (optical and magnetic printing for the text) more complex, and the recourse to an analogue recording requires a precise alignment of the device with the recording, on the one hand, as well as the good reproduction of the sound, on the other hand, which reproduction is dependent upon a precise and regular speed of moving (such as is carried out on the "DICTAPHONE" apparatus by means of magnetic sheets, but which would only include writing in an accessory manner).

The solution claimed in accordance with the invention corresponds to preserving a single support (or a support additionally having another function [example: cowling of the machine, casing wall, etc.]), for the writing and the sound, and to marking down the same by means of a digital code arranged under every word or phrase, or on a transparent sheet of slightly different quality arranged on the text from which it is desired to obtain the pronunciation.

The digital coding is obtained, in a preferential manner, by means of simple written symbols (lines, the spacing, width and height of which have numerical values, or code values, points, parallel lines, in order to increase the density of information within a single passage). The thickness or the color of the lines or points of code can likewise have a benchmark value.

The symbols can be carried out by magnetic, electrostatic, radioactive, or chemical means, in electrical or magnetic form, similar to the memories used for microprocessors, but the unity of manufacture is then lost.

This coding with digital value must be read at a speed which is not very precise, such as by means of an "optical pen", for example. The printed code comprises synchronization taps. These, when marked by the pen, are compared by an electronic "clock" which forms a part of the processing system associated with the pen and makes possible the assembling of the "bits" or the generation of orders connected with these bits with a perfect rhythm which is not connected to the possibly random moving speeds of the reading pen.

In point of fact, this involves replacing the diskette support or the hard drive or cassette with a numerical memory with a support (most often of paper) and replacing the magnetic prime coatings or the charges with "spots" with coefficients of reflux luminous intensity different from those of the support, in order to benefit from the optical ease of carrying out the support and the use of the optical reader.

The number of codes per second of speech is excessively variable, depending on the method used:

- Either eight "bits" per letter -- but, in this case, one is brought back to the second case described above, unless one is freed from the body of writing (but not from libraries of phonemes and of grammar);

- Or, 200 bits per second, by not coding the sequences with very low intervals corresponding to the speech, but by instead coding the characteristic parameters of every second of speech (fundamental frequencies, slope of the curve of the voice);

- Or, by coding at 32- or 64,000 bits per second, either with or without a reduction of the description of the voice, which is the best coding which allows not only an excellent understanding, but also the recognition of the origin of the speaker.

In the case of optical coding, the bar codes originate from an analysis of the sound by a digital analogue converter. They are, for example, stored on a magnetic support, which proceeds to generate the optical codes on the reading support, preferably by means of photocomposition, in which the characters are ... /text cut off at bottom of page/ ... of characters on a film, or by means of an electronic generation of characters, with this latter method permitting resolutions of up to 50 lines per millimeter.

The bits read by pen are, preferably, stored in a buffer memory, and their synchronization bits compared with the bits of the clock. Then, a signal is reconstituted (vo-coder with pulses, or a numerical or digital / analogue connector).

There is a choice between the simplest simple (coding of the different samples, such as 3,000 per second at 8 bits each, for example), but which requires a very high number of bits and an ultra-simple pen, and the system with 200 bits (synthetic voice), for example, with the first requiring a support of quality and the second [requiring] any type of support (1 second of speech often requires 20 letters, or 40 mm of conventional text, or 40/200 = 0.2 mm per bit).

The limitation of the thickness or the spacing of the codes is directly connected with the definition (grain) of the paper and the resolution of the optical pen. It is noted that it is possible to activate a machine, in a parallel manner, by means of a vocal command (in the case of a single vocal entry for this machine). There is thus the following sequence:

- Digital coding (preferably optical) on the support;
- Pen, decoder, storage, processing;
- Vocal output.

In definitive terms, the following is carried out in accordance with the invention:

- A digital code, either coding the significant elements of the speech (or of the music), or the values of the various samples representing this speech, preferably put into place optically on a support, preferably of paper, which is, that is to say, compatible with printing, and using bars (with different thicknesses and/or distances). The code read by the pen (preferably optical or electrical, etc.), is placed into memory within a buffer memory, monitored, preferably by means of a microprocessor, synchronized, and then reinjected, with a correct output, to the input of an electronic processing card or a digital / analogue card, in order to issue a signal converted into a sound signal.

- The code may correspond to points or spots of different thicknesses or colors.

- The code is put into place in the vicinity of the line printed or a diagram, or on a plate having another function.

- The code is what is pronounced or translated, or is the explanation of the corresponding text or diagram.

- The code is put into place on a transparent sheet inserted between the normal pages of a classical book.

- The code is carried out by means of a detectable "ink", but not visible to the naked eye.

- The decryption uses all known means based on a mobile element, such as with the following, for example: Battery -- optical reader -- synchronization -- combination, as well as a speaker in the ear, if miniaturization is sought.

- A part of the electronic apparatus is in the form of a "box" processing the information.

The code may comprise several lines for a single line of text printed. These lines can be read one after the other. They may also be read simultaneously by means of a pen with several reading heads, [with] an appropriate electronic device then restoring the lines in the order desired at the end of the reading.

The figures of the two attached diagrams illustrate certain of the particular features stated above.

Figure 1 depicts an operator (1) using a book equipped with codes in accordance with the invention. Upon viewing the book (2), he moves an optical pen (3), which a flexible cable (4) connects with the electronic casing (5), which issues the sound signals transmitted by a flexible wire (6) to an earpiece (7).

Figure 2 depicts the book (2) and the pen (3) in greater detail.

Figure 3 represents, on a larger scale, a segment in which the written text is distinguished by letters, such as (8), and the tracings of the codes, such as (9), with codes printed under the words formed by the said letters.

Figure 4 depicts a book (2), such as a complete and current dictionary, for example, between each printed page, with transparent inserts (10 and 11) corresponding to a left-hand page and to a right-hand page, respectively, and which bear codes such as (9). These inserted sheets may be either immovable or fixed to the book.

Figure 5 depicts a fragment of musical notation on one level. Opposite to this, the code (9) reads back the corresponding meanings.

Figure 6 is the logic diagram for reading, in which the digital signals read by the pen are reduced and placed in the buffer memory, then repeated, in real time, after synchronization by the clock, in order to obtain a correct output of the reproduction, with the same being issued by the digital / analogue converter which activates the microphone or earpiece (7).

It will be noted that the use of the system may be facilitated by means of special punctuation signals in order to separate the various phrases, for example. This particular point is useful, particularly in the event that the code occupies a longer space than the text placed opposite to it.

CLAIMS

1°) A process for reading signals representing a sound message and coded in lines on a support, by means of a reading head (3) held in the hand and moved along the length of the code in contact with it or in proximity to it, with optical or magnetic recognition of the code (9) by means of the head, with an electro-acoustical transducer (5) being connected to the head by means of flexible wire (4) and restoring the sound signals, characterized in that, the code is of the digital type.

2°) A process in accordance with claim 1, characterized in that, the digital code comprises points or bars with a pitch limited by the definition of the recording system.

3°) A process in accordance with one of the claims 1 or 2, characterized in that, the code comprises several parallel lines bearing successive portions of the same message, read simultaneously in the same multiple reading, and then successively restored by the transducer.

4°) A process in accordance with one of the claims 1 to 3, characterized in that, the transducer restores the correct frequencies of the sound signals, whatever the speed of the motion of the reading head along the code might be.

5°) A process in accordance with claim 4, characterized in that, the digital code comprises synchronization taps which, once marked by the reading head (3), are compared within the transducer with the signals of a clock in order to restore the correct frequencies of the sound signals.

6°) A process in accordance with one of the claims 1 to 5, characterized in that, the digital code is arranged, during its reading, opposite to the printed line (8) of a text or of a diagram.

7°) A process in accordance with claim 6, characterized in that, the digital code records the enunciated text, the translation, or the explanation of the corresponding text or diagram.

8°) A process in accordance with one of the claims 6 or 7, characterized in that, the code is put in place on a transparent sheet (10) (11), inserted between the normal pages of a book (2).
